2012 National Science Bowl®
Official Electric Battery Car Competition Rules

Background

For the National Science Bowl event in 2012, the Department of Energy (DOE) will host an electric battery model car competition. One of President Obama's national clean energy goals is to put one million electric vehicles on the road by 2015. This is a key milestone to dramatically reduce the dependence on oil and ensure that America leads in the growing electric vehicle manufacturing industry which aligns with DOE's strategic plan. As part of the education outreach, middle school students will be challenged to design, build and race model lithium ion battery cars as part of the engineering design competition for the National Science Bowl.

The Electric Battery Car Competition is a classroom-based, hands-on educational program for 6th, 7th, and 8th grade students. Student teams apply math, engineering, science, and creativity to construct and race a model electric-powered car.

The primary goals of the programs are to:

- Generate enthusiasm for science and engineering at a crucial stage in the educational development of young people,
- Improve students' understanding of scientific concepts and renewable energy technologies, and
- Encourage young people to consider and prepare for technical careers at an early age.

Program description:

- Students use mathematics and science principles together with their creativity in a fun, hands-on educational program.
- Using engineering principles, students get excited about generating ideas in a group and then building and modifying models based on these ideas.
- Students can see for themselves how changes in design are reflected in car performance.
- Students work together on teams to apply problem solving and project management skills.
- Students document their questions, discoveries, and progress in a design document which will be submitted for review.

The car competition challenges students to use scientific know-how, creative thinking, experimentation, and teamwork to design and build high-performance model electric vehicles.

RULES

Competition Structure

The National competition will use preliminary time trials before progressing to a modified double elimination tournament for the finals. Each team will have three time trials to achieve their fastest time. Any car that does not finish in 30 seconds will be considered a Did Not Finish (DNF). Only the fastest 16 teams will progress to the modified double elimination tournament. In the event of a tie, the double elimination tied teams will have a race off to qualify for double elimination.

There are two components to the national competition:
Speed Race: Student teams will be provided a lithium ion battery, motor, battery connector, battery recharger, and an A/C adapter. Students must use the unaltered battery, wire harness and motor provided in the kits as the only method of powering the car. The rest of the car design and components will be up to the creativity and ingenuity of the students. All cars must be designed and built only by the students with limited assistance from the coach, parents, mentors or **other non-team** student members. Any car that does not finish in 30 seconds will be considered a Did Not Finish (DNF).

Design Document: At the national competition, each team must provide design notes for its car before being allowed to compete. The design document is not a daily journal, it must be an **engineering schematic**. Minimum requirements include: a complete component list for the vehicle, final specifications of the vehicle (body measurements, weight, gear ratio, drive type, top speed), scaled drawings, assembly procedures, at least three issues or problems encountered and solutions applied, and photos of the car and/or its construction. This document will not be returned to the team, and all or parts of it may be made public.

Materials:

1. An electric battery car kit will be provided to the winning academic regional teams following their regional events. Each regional winning academic team must bring a completed and functional car to the National event as part of their teams eligibility for the National Science Bowl.

2. The lithium ion battery sold by Horizon Hobby is the only battery that may be used. Only the authorized motor (Mabuchi 280), battery, battery connector and battery charger supplied with the kit may be used. Motors may not be re-wound or disassembled. Any other batteries and motors may not be used in the competition. All parts mentioned here must be used without modification. Only one battery and one motor is allowed per car.

3. The remainder of the vehicle must be the students own design and can be made from any other material.

Race Specifications

4. The vehicle must be safe to contestants and spectators, e.g., no sharp edges, projectiles, etc. The vehicle cannot exceed the following dimensions: 20 cm wide by 40 cm in length by 20 cm in height. Decals of the sponsor organizations (provided at the National competition) must be applied and visible from the side, top or front of the body of the car. A 3 x 3 cm space must be left for the assigned car number and sponsors. The 3 x 3 cm space must be on either side of the vehicle, not the top or bottom. An on and off switch can be incorporated into the car design, if desired.

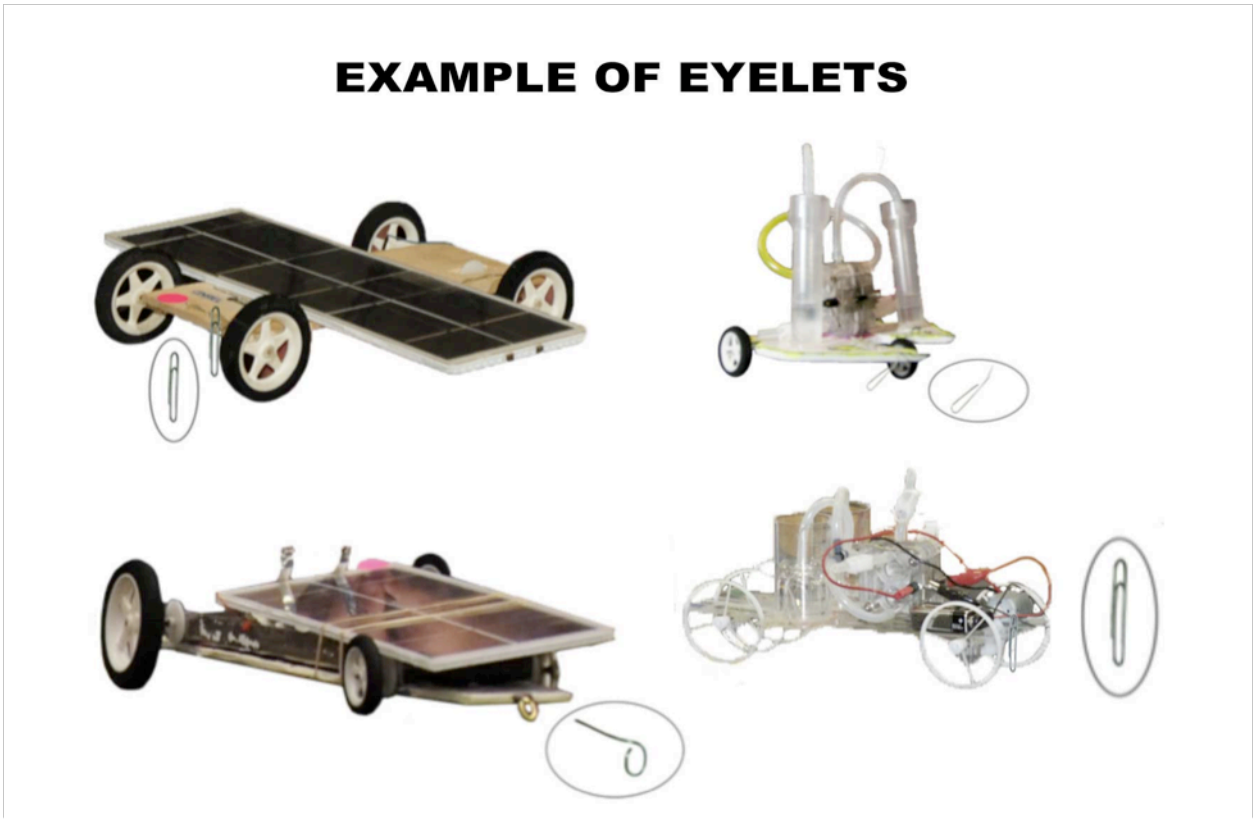
5. The vehicle must be designed with a compartment to carry a payload of 1 full water bottle. At the regional competitions, each regional Science Bowl coordinator will determine the dimensions of the water bottles for their regional races. The water bottle for the National Competition will be a Dasani 20-ounce water bottle with the following dimensions: height of 22.5 cm, circumference of 21.5 cm at the label, circumference of 23 cm at the widest point, and diameter of 6.5 cm at the base. The bottle may not be part of the vehicle's structure and must be easily and rapidly removed or reinserted. Velcro, tape, or any other adhesive cannot be used to secure the bottle. The water bottle will be supplied at the starting line and must

remain unaltered. The bottles will be reused for each race. The bottle can either stand up or lay on its side, however, it must remain in the compartment for the entire race. If the bottle falls from the compartment during the race, this will result in a DNF.

6. Energy Source: The lithium ion battery can only be recharged with the battery charger provided in the car kit.

7. Steering: A guide wire attachment, referred to as an eyelet, must be attached to the car. Examples of possible designs are shown below. A guide wire, such as a fishing line, will be no more than 1.5 cm from the surface of the track. This guide wire will go through the attached eyelet on the car, serving as the steering mechanism, and keeping the car in its lane. The vehicle must be easily removed from the guide wire without disconnecting the guide wire. This is the only allowable method of steering the car. No radio control is permitted in the cars. Lane changing or crossing will result in a Did Not Finish (DNF). A car whose run was interfered with will be allowed an additional opportunity to run.

8. The eyelet must be used for steering only and must be directly hooked onto the guide wire. Any guide wire attachment or eyelet used should not support the vehicle (such as a grooved spool located on top of the car guiding the car down the track). All wheels must be in contact with the track. The guide wire must be attached to the car throughout the course of the race. If the car disengages from the guide wire, this will result in a DNF.



The length of the racecourse is 20 meters over flat terrain. Race lanes are at least 60 cm wide. The guide wire will be located in the center of the track and will not be more than 1.5 cm above the track surface. At the National competition, the track material will be a black neoprene rubber material.

Race Conduct

9. Charging Station: The battery recharger received in the kits must be used to recharge the battery. Electricity to plug in the battery rechargers will be available and located in the impound/repair area.

10. There will also be a repair table set up to help facilitate quick repairs to the cars. Teams that are scheduled to race in the next heat will be given priority in the repair area. There will be a 3 minute time limit for repairs.

11. At race time, the vehicle will be placed behind the starting line and all wheels must be in contact with the ground. No more than two team members will be allowed in the start area. Teams will have ONE minute to be ready to start their race at the specified time.

12. An early start or push start will result in a DNF for that heat.

13. All vehicles will start when the official signal is given. Each car will have three timed speed trials. The 16 cars with the fastest times on individual trials will advance to the final competition to race for first, second, and third places.

14. For the National competition there will be an electronic timing system that will post the race results. If the timing system is not available, the judges will note the official time on the heat card (See Appendix A). If the car does not finish the race, it will be noted as a Did Not Finish (DNF) on the heat card.

15. At least one team member, but no more than two, must wait at the finish line to catch the vehicle upon completion.

16. Team members may not accompany or touch the vehicle on the track. Vehicles stalled on the track may be retrieved after the end of the race has been declared by the Lead Judge. **Students must not walk on the track!**

17. The vehicle and team member must remain at the finish line until the time of the race has been noted either by the electronic timing system or on the heat card.

18. Challenges must be made before the race judges begin the next heat. All challenges must come from the team members who are actively competing, not the coach, parent or coordinator. All challenges need to be directed to the lead judge, decisions of the race judges are final.

19. Only competing students and race officials may be in the race area. All others including coaches, parents, mentors, coordinators, and non-competing students must remain in the spectator stands through the duration of the races. Teams will be disqualified if the coach interferes with the race.

20. Judges may inspect cars at any time before, during or after heats.

Appendix A-Sample of a Heat Card

National Science Bowl Car Competition

Electric Battery

Car #: 13

Time Trial

Heat	Lane	Time
1	D	4.32
2	B	4.89
3	E	4.72

Double Elimination

Heat	Lane	Time
1	A	5.01
2	G	4.46
3	E	DNF
4		
5		